Amendments to the Specification

Please replace the paragraph beginning at page 13, line 22, with the following amended paragraph:

[0055] Referring to Fig. 2, a simplified diagram of an apparatus for producing fiber Bragg gratings (FBGs) according to an embodiment of the invention is shown. The apparatus comprises: a laser source 20 for providing ultra-short duration pulses of laser light; a cylindrical lens 21 for focusing the ultra-short duration pulses at a target 24; a diffractive optical element 22; and, an optical waveguide 23 having a target portion 24. In use, the optical waveguide 23 is biased against a fixture and the target portion 24 of the optical waveguide 23 is stripped of any external jacket. The diffractive optical element 22 is positioned adjacent to and aligned with the target portion 24. When the laser source 20 is activated it emits an ultra-short duration pulse of laser light. The ultra-short duration pulse propagates from the laser source 20 and is directed to pass through the cylindrical lens 21. The ultra-short duration pulse then propagates from the cylindrical lens 21 to the diffractive element 22. The diffracted ultra-short duration pulse of laser light then propagates into the optical fiber wherein an interference fringe pattern is generated. The intensity peaks of the interference fringe pattern are spatially oriented along a length of the optical fiber to cause periodic index changes within the fiber at predetermined intervals, thus forming a Bragg grating therein. Although this embodiment of the invention relies upon a cylindrical lens 21 for focusing the ultra-short duration pulses of light this need not be the case. In an alternative embodiment of the invention, means for providing optical power in the form of a focusing mirror is used to focus the ultra-short duration pulses of light instead of the cylindrical lens 21. Although this invention is particularly suited to writing gratings, such as Bragg gratings in the core or cladding of standard telecom optical fiber without the requirement of photosensitizing the waveguide or fiber, it is also suited to photoresist patterning in optical material and to direct patterning of glasses, semiconductor materials, non-linear crystalline materials such as ~~$LiNO_3$~~ $LiNbO_3$. Such surface and volume holograms are optionally used for optical encoding and data storage. Similarly taps can be generated by writing Bragg gratings at an angle in the form of a blazed grating as described by Hill et al in United States Patent 6,385,369. The invention as described in reference to Fig. 2 improves on remote imprinting of interference fringes generated by a phase mask by using peak powers that are below the damage threshold of the phase mask and; below the threshold of supercontinuum generation that has been correlated with nonlinear self-focusing processes, which lead to damage. The intensity levels incident on the fiber waveguide that are required to create photoinduced index changes in Ge-doped fibers are not as high as previously thought as there seems to be preferential multi-photon absorption in the Ge-doped region as opposed to the undoped cladding. It is unclear if the preferential multiphotonic absorption in the core is due to the presence of the Ge dopant or is more generally due to a multiphotonic self-focusing

process that is accentuated as a result of the step index change at the circular core cladding interface that is a lensing effect of the core. Embodiments of the invention featuring a silica phase mask permit the placement of the silica phase mask in close proximity to the target waveguide without damaging the silica phase mask, when laser intensities below the damage threshold of the silica are used. Thus, in an embodiment of the invention, the diffractive element is a silica phase mask. Indeed, the phase mask is optionally made of any material that is transmissive to the range of wavelengths of the ultra short duration pulse of laser light. Suitable materials include BK7 glass, soda lime glass, plastic, and UV transmissive glasses such as silica, calcium fluoride, and magnesium fluoride. Alternative embodiments of the invention feature a phase mask that is not transmissive to the incident ultra short duration pulse of laser light. For example, the phase mask is optionally a frequency-doubling medium like a crystal with an antireflection coating in the infra red so that visible light from an ultra short duration pulse is generated in the phase mask and the generated light diffracted but the IR light is reflected.